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The Forester

YOUNG DOUGLAS FIR IN OREGON.

A monthly magazine, devoted to the care and use of forests and forest trees and related subjects.

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THE AMERICAN FORESTRY ASSOCIATION.

ORGANIZED APRIL, 1882.
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The object of this Association is to promote:

1. A more rational and conservative treatment of the forest resources of this continent.
2. The advancement of educational, legislative and other measures tending to promote this object.
3. The diffusion of knowledge regarding the conservation, management and renewal of forests, the methods of reforestation of waste lands, the proper utilization of forest products, the planting of trees for ornament, and cognate subjects of arboriculture.

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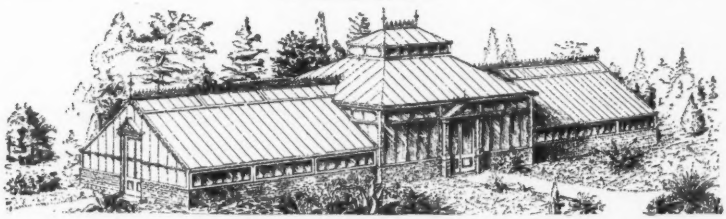

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Annual Meeting.

The annual meeting of the American Forestry Association will be held in accordance with Article XII of the By-laws, on December 14, at 11.00 o'clock A. M. in the hall of the Cosmos Club, 1518 H Street, Washington, D. C.

The business to come before the meeting will be the election of officers, presenting of reports and such other matters as may be suggestsd.

A full attendance is earnestly requested.

The Forest Reserves.

On March 1, 1898, the lands embraced in the eleven forest reservations, which were suspended by the act of June 4, 1897, again became subject to the operation of the proclamations of February 22, 1897, by which they were created. This added 19,951,360 acres to the area previously reserved. By executive proclamations, dated March 2 and June 29, the Pine Mountain and Zaca Lake Reserve in Southern California was created. It has an area of 1,644,594 acres. On the 10th of May the Prescott Forest Reserve, a tract of 10,240 acres in central Arizona, was set aside by executive proclamation. By another issued May 27 the limits of the Pecos River Forest Reserve were extended to include an additional area of 120,000 acres. In its new form it covers 431,040 acres. Since the beginning of the fiscal year two new reservations have been established and the bounds of one have been enlarged. Two proclamations were issued on the 17th of August, one creating the San Francisco Mountains Forest Reserves with an aggregate area of 975,360 acres and the other the Black Mesa Forest Reserve, the area of which is 1,658,880 acres, both in Arizona. The Territorial Legislature had addressed a memorial to Congress, praying that a sufficient area of unclaimed and unappropriated timber lands on the mountains and water sheds in that Territory be set apart to retain needed water supplies in the interest of irrigation. Similar action was taken by the Phœnix Chamber of Commerce. Some opposition was manifested by miners and lumbermen, but, after careful investigation of all interests concerned, the Interior Department recommended the establishment of the reserves. They include he headwaters of the Little Colorado,

Salt and Verde Rivers. The two latter streams are of the very greatest importance in the agricultural development of central Arizona. The land embraced in these reserves is all of a mountainous character, and contains some of the highest land in the Territory. The Black Mesa Reserve adjoins the White River Indian Reservation, and it is probable that its limits will be extended in event of the extinguishment of the Indian title to contiguous timber lands. The San Francisco Mountains Forest Reserves consist of 1,524 even-numbered sections of land lying within the forty-mile limit of the Atlantic and Pacific Railroad. The segregation of these areas in severalty was rendered necessary by the "lieu land selection" clause of the act of June 4, 1877. This would render it possible for parties holding deeded lands within the limits of a reserve to strip the timber from the same and then demand the right to select in exchange, acre for acre, any unclaimed agricultural land in the Territory, a proposition that is manifestly unfair.

By proclamation, dated September 19, the Black Hills Forest Reserve was altered by the exclusion of 189,440 acres, most of which is practically devoid of timber, and by the addition of an extensive area amounting to 433,440 acres, of which 45,600 acres are in the State of Wyoming. The reserve thus remodeled has a total area of 1,211,680 acres.

There are now in all thirty-two forest reserves with a total area of 43,597,714 acres. Other reservations are being petitioned for, several of which are certain to be established within a few months. The friends of forestry have reason to feel encouraged. Public sentiment and a real public forest policy are both becoming apparent. Henceforth we may reasonably expect more rapid advancement.

The Sanders & Egbert Company, hardwood lumbermen, of Goshen, Ind., recently paid John M. Newton, of Decatur, Mich., the sum of $10,000 for fifty-one Walnut trees growing on his farm.

Protecting the Reserves.

The appropriation for the maintenance of a force of officers and men for the care and protection of the Federal forest reserves became available July 1. The work of organization was immediately begun, but several weeks elapsed before patrols were established on all the reserves. The thirty-two reserves were grouped into eleven districts, each of which was placed under the direction of a forest superintendent. Subordinate to the superintendent was placed a supervisor for each reservation in the district, and under the personal direction of each supervisor were the forest rangers, varying in number according to the size of the reserve. Their duties are to patrol the reserves and prevent fires and trespasses. In the necessarily hasty organization of the required force it is not improbable that some of the individuals selected may not prove to be entirely competent and trustworthy. As a result there have been many caustic criticisms passed upon the character of the service rendered. Some of these were doubtless not unmerited, in so far as they concerned individuals here and there, but, on the whole, great allowances should be made. For instance, in some localities this force has been blamed for negligence in permitting the spread of general forest fires, some of which were a hundred miles or more from the nearest patroled reserve. Considering that this service could not be inaugurated until late in the season and the other difficulties to be overcome, harsh judgment is premature. The service rendered in several of the States was satisfactory beyond the most sanguine expectation of the projectors of the measure. The Secretary of the Interior and the Commissioner of the General Land Office are certainly deserving of great credit for the fidelity and persistence with which they have labored to secure some definite and timely action for the preservation of the timber on the reserves. The system may not be perfect nor the service entirely satisfactory, but it must be remembered that it was organized to serve

the immediate purposes of the hour. The proper organization of a permanent corps for the administration and management of the public forests, such as an enlightened nation should have, is a task for the future. Experienced woodsmen and lumbermen are to be had in plenty, but as yet technically trained and educated foresters, thoroughly competent in all other details, as well as those merely mechanical, are few in number, though hopeful signs indicate that the ranks of this profession will now be rapidly augmented. It may be said that anything which tends to improve existing conditions is deserving of encouragement. For this reason the General Land Office should have most liberal support in its commendable effort.

The General Land Office.

The Annual Report of the Commissioner of the General Land Office, recently issued, is a comprehensive document of 112 pages, filled with interesting matter throughout and embodying some important recommendations. During the fiscal year ending June 30, 1898, there was in all classes a total of 99,806 entries and selections made, covering 12,909,607 acres; the cash receipts from sales were $1,391,393.59, and fees and commissions $853,265.50. There were 30,293 agricultural patents issued, covering approximately 4,846,880 acres. The mineral and mill-site patents were 1,259 in number and embraced an area of 31,605 acres. The lands certified or patented on account of railroad grants amounted to 1,069,534 acres a decrease, of over 4,000,000 acres as compared with total acreage so disposed of during the preceding fiscal year. In all classes patents were issued for 6,632,736 acres of land, a net decrease from a like total of the preceding year of 5,682,215 acres. The estimated area of unreserved and unappropriated public lands is 579,368,274 acres, exclusive of Alaska. During the year surveys were accepted by the office for 6,237,371 acres. The report devotes considerable space to the discussion of matters pertaining to the reclamation of arid lands, giving a brief description of several proposed reservoir sites. During the year the Commissioner, by inexhaustive personal investigation, discovered that the northwestern portion of the Louisiana purchase had been erroneously delineated on Land Office maps of the United States and that its true northwestern boundary is defined by the Continental Divide. This error has been corrected in the official map for 1898, and the area bounded by the forty-second and forty-ninth parallels of north latitude between the Continental Divide and the Pacific Ocean is properly indicated as "Acquired by discovery, 1792; exploration, 1805; Astoria settlement, 1811; and Florida treaty, 1819."

The report enters into a very thorough discussion of the forest reservations and their treatment during the past year. As these matters are considered elsewhere in this issue, it is scarcely necessary to review all of this part of the report in detail. Referring to the operation of government forest management in other countries the Commissioner draws the pertinent conclusion that "successful results are in direct ratio to the liberality of expenditure for the service and degree of scientific training given its officers." The subjects of forest fires and sheep-grazing are then treated in their relation to the reserves. The report notes the favorable change of public opinion as regards the forest reserve policy in certain localities. It is stated that so far it has not been possible to practically enter upon the work of conducting sales of timber as provided by law. However, the subject is receiving careful consideration by the Commissioner with a view to the early inauguration of a business-like system of timber cutting. In regard to this matter the Commissioner says: "The work is clearly one which will require, to a certain extent, experience and training on the part of forest officers; since, otherwise, the forests may suffer seriously as the result of such operations." The

practice of issuing permits to cut timber free of cost, on unreserved public lands, has been discontinued under the present administration, yet it seems impossible to regulate the use of timber on unreserved public lands, so the Commissioner officially endorses the opinion that "No good reason can be given for the maintenance of the present reserves which does not also demand the withdrawal and protection of all similar lands now held by the Government." Specific remedial legislation is recommended. Depredations upon public timber are reported as numerous, some being within the bounds of reserved areas. During the year $23,487 were received as compromises and settlements and from sales, and $120,762.73 from fines and judgments obtained as the result of such prosecutions. At the close of the fiscal year there were pending in Federal courts 140 civil cases for the recovery of a total amount of $3,224,327 for timber alleged to have been unlawfully removed from public lands. There were also 412 criminal prosecutions pending for violation of public timber laws. Several pages of the report are devoted to the Chippewa ceded lands in Minnesota. In reference to complaints concerning inaccurate measurements and the men who made them, the report says: "Many of these men testified, when examined by Special Agent Wright, that they had had no previous experience in the business of estimating timber and admitted their incompetency." In consequence of this the lands were not only withdrawn from sale but a re-examination of Pine land areas was ordered, a new board of examiners being appointed, of which the report says: "Special care was taken to select competent men, who were from a timber region and versed in estimating timber."

The recommedations include modification of law respecting lieu selections of tracts relinquished in forest reserves; of legislation for disposal of coal lands in the reserves; for renting lands in reserves for hotel and sanitarium purposes, also for grazing; of repeal of timber land laws of June 3, 1878, and August 4, 1894; of withdrawal of lands chiefly valuable for timber for forest reserves; of general law for protection and use of timber or unreserved lands; of increased force of special agents to protect public timber.

The Department of Agriculture.

The annual report of the Secretary of Agriculture presents an interesting outline of the work done by that Department during the year ending June 30, 1898. The work of each bureau, division and office of the Department is briefly but thoroughly reviewed. In addition to this, valuable suggestions are offered concerning the introduction of nature teaching in the common schools and the necessary training of teachers for that work. The establishment of courses of study for post-graduate students in connection with the Department of Agriculture is also advocated Increased appropriations are recommended in it for several purposes, notably for irrigation investigations and for the Division of Forestry.

After telling of the change in the head of the Division of Forestry, the report refers to the increased activity of the Division in regard to forest-planting experiments in co-operation with State agricultural experiment stations. Reference is also made to the elaboration of a plan for the introduction of exotic species adapted to dry climates. The work proposed for the Division and approved by the Secretary is along entirely new lines and is expected to yield results of great practical importance. This part of the report then concludes:

"The plans for the Division of Forestry, approved by me, for the coming year cover the following lines of work, all of which are directly related to the welfare of our people:

"Practical assistance to farmers, lumbermen and others in handling private forest lands. Since these lands exceed by far in area those of the Government and the States combined, woodland in

farms alone covering more than 200,000,000 acres, this attempt to increase their present as well as their future value and thus secure their preservation has before it a field of wide usefulness.

"An attempt to find the best trees for planting in the so-called treeless regions of the West, a matter of far-reaching importance to a very large percentage of the farming population of this country.

"A study of the history, nature and ways of action of forest fires in the United States and their effect on the composition and reproduction of forests. The prime object of this work, which covers a field practically untouched until now, is to develop better methods of preventing and extinguishing these fires than have yet been employed.

"A study of the effect of lumbering on the forests in order to devise improved methods advantageous both to lumberman and to the forest. Combined with this work, detailed investigations of the growth of trees of special commercial importance will be made, with the object of ascertaining whether and how much it will pay to hold timber land for future crops.

"Investigation of the timber resources and requirements of Alaska, Cuba and Puerto Rico, which is needed to meet the numerous requests for information made to this department.

"In addition, a classified series of forest photographs, intended to furnish illustrations of the results of the various lines of work, will be begun during the year.

"The extremely practical character of these lines of work is evident. Their popular standing is indicated by the fact that the assistance of the Division has been asked in the handling of nearly a million acres of forest land, under an arrangement by which, in the case of all but farmers' wood lots, the Department is relieved of all expenses, except salaries for its agents in the field.

"In view of these facts I have been impelled to lay before Congress the urgent need of a considerable addition to the appropriations at my disposal for the use of the Division of Forestry."

Forest Fires.

For months the fire fiend has in the Rock mountains destroyed thousands of acres of the finest timber, the great shelter and storage of water, the only means that keeps back the floods of the spring and retains the exhilerating fluid for the time when it is most needed by the husbandman. Shall we stand idly by and see the fine forests of this great country wantonly destroyed without an effort to stay the element that will cause this section to become a desolate barren waste? If this destruction is permitted to continue, instead of beautiful mountains with healthful springs, brooks, creeks and rivers along which are thousands of homes, we will have here a hilly sahara, a region of deserts. It is noticed that, through fires of former years, streams which, a decade ago, were well filled the entire year, are now drying up in the early summer leaving ranchmen who live along these streams to fight for the few drops of water, even as the irrigation season commences. It is true that, through costly engineering, water storage reservoirs can be constructed but rarely will they serve the purpose the forest did before them, because repairs and other expenses bring the water rate so high that only high productive ground would repay the outlay.

Millions of dollars are annually expended to protect settlers along water highways and still much property is destroyed by floods. These floods are bound to increase as the forest is destroyed, because the snows of the winter will melt in early spring and transform the mountain streams into torrents carrying before them everything in their path, inundating low points and tearing away the humus thus making such lands unproductive. Nature has destined the forest to hold the snow for a later season and wherever nature is interfered with it avenges itself.

Legislatures and Congress have passed laws presumably for the protection of forests, albeit these laws as they apply to the public domain are dead letters indeed. A few warning signs printed on

cloth are sent out annually to be posted, which tell the people that live coals or ashes must not be left in forests under penalty of a given sum. Some charitably inclined person will tack up these signs and the newspapers usually print the warning but there it ends. There is no one to prosecute, no one to follow up a case, no one to do anything.

"What is everybody's business is nobody's business," is an old saying and true. It cannot be expected that one citizen tell on the other and bring about his wrath for the sake of something that does not directly concern him, and there are other reasons. It must be made the business of some one or a number of men if necessary to ferret out the culprit. The National Government must place a guard over certain sections and a few prosecutions and punishments will soon bring about the desired result. Here is work for Congress that is almost as important as the acquisition of new territory.—*Laramie (Wyo.) Times.*

The foregoing editorial (originally double column and double leaded) is republished here as an illustration of the sentiment with which the forestry question is regarded in Rocky Mountain regions. Scores of other journals in the mountain States have expressed themselves in equally as strong terms. If the picture be over drawn—and more often it is not—it may be set down as a fault of the head and not of the heart. In Wyoming during the past season, one man at least, a Mexican sheep herder, was placed under arrest, charged with negligence in starting a forest fire, and, failing to give bond, was remanded to jail to await trial. In southern California several parties were arrested on the same charge and gave bond to appear for trial. It is indeed well that the press and public sentiment in the states where the greatest interests are concerned have been fully aroused to the gravity of the situation, yet there is no occasion to take a pessimistic view of the matter. It is true that, during the past season, many disastrous forest fires have occurred while in many cases the miscreants who caused them escaped detection, yet the fact remains that the Federal authorities directly charged with the apprehension and prosecution of such offenders were never before so active and alert in the discharge of their duties. In districts where it has hitherto been almost impossible to arrest the real offender, let alone secure his conviction, and where public sentiment at best has favored but a lax construction of the law a sudden reversal of policy cannot be expected to be an immediately successful operation. Even if no convictions result from the prosecutions for offenses committed during the past season it is yet evident that substantial ground has been gained in the creation of local sentiment that in the future will endorse and support official efforts in a literal enforcement of the forest laws.

A Glimpse of the San Gabriel Forest Reservation.

By John H. Barber.

Prominent among the national forest reserves set aside in recent years are those of southern California, and they are of exceptional importance, not so much for their timber value as from the standpoint of protection to water sources. Upon the preservation of these sources depends to a large extent the continued prosperity of the great horticultural interests of a large extent of country, and the establishment of the forest reserves to this end has contributed in no small degree to the assurance of the future of the dominant industry of southern California.

Of these reserves, which cover a practically continuous belt of mountains and embrace an area of some two million acres, the San Gabriel Reservation is the most westerly. It extends over the entire length of the Sierra San Gabriel, or Sierra Madre as the range is also called, protecting all the principal watersheds of Los Angeles County, as well as some of those of the adjoining county of San Bernardino. Near its western boundary lies Mt. Gleason, or Gleason's Peak, one of the higher sum-

mits of the range, reaching an altitude of 6,414 feet above sea level.

Geographically this peak is near the center of Los Angeles County, though to the northward of the commercial and horticultural centers of the county. It is distant a few miles southeast of the small mountain town of Acton, on the Southern Pacific Railroad, and about sixty miles north of the city of Los Angeles, whence it is reached by way of the San Fernando Valley and the Soledad Pass. Acton itself lies at an elevation of 2,600 feet above sea level, surrounded by mountains. A few miles further north the mountains descend to the great amphitheater of the Antelope Valley, the western portion of the Mojave Plateau. This mountain region has been thoroughly prospected, and many mining claims, some of them valuable properties, have been located in the vicinity of Acton. A number of these claims are on the slopes and in the cañons of Mt. Gleason, five or six of them occupying a considerable portion of its summit.

The forest cover of Mt. Gleason is fairly representative of that of the entire San Gabriel Reservation, though on the highest peaks the number of species is, naturally, somewhat greater. The best of the timber is on the summit of the mountain, a park-like expanse of rolling table-land several square miles in extent, breaking off precipitously to the south and east, but to the north and west sloping more or less gradually into narrow cañons. These debouch mainly into the great cañon so appropriately named in the musical Spanish, Cañon de la Soledad, which cradles the upper reaches of the Santa Clara River.

The sides of the cañons, and the mesas between the cañons are covered with a dense scrub growth or chapparal consisting chiefly of Manzanita (*Arctostaphylos manzanita*), Wormwood (*Artemisia californica*), Greasewood (*Adenostoma fasciculatum*), Mountain Lilac (several species of *Ceanothus*, and Yerba Santa (*Eriodictyon californicum*). Manzanita predominates on the higher slopes, Greasewood and Artemisia on the lower, with Ceanothus in patches, Scrub Oak in the cañons, and Yerba Santa and Yuccas intermingled everywhere. The only trees of any size are the Cottonwoods (*Populus fremonti wislezeni*) along the watercourses in the cañon bottoms, which here replace the Sycamores (*Platanus racemosa*) of the coast region, an occasional Maple (*Acer macrophyllum*), and in wet spots here and there small thickets of young Alders, which are said to have appeared in the locality quite recently. At the mouth of Aliso Cañon were noticed the Sycamores from which it takes its name, but they are few and of no great size.

Above the mesa formation the rolling uplands in places run in smooth hogsback ridges where the chapparal is so thin that one may ride through it without difficulty, while the crests of the ridges form natural roads along which a wagon can be driven with ease. On these ridges and in the gullies between them the washing of the winter rains now allows no accumulation of humus, and they are practically destitute of herbage. The soil is a clear sand of quartz and granite, more or less metallic. Against its glaring whiteness the naked fire-blackened stems of Greasewood and Manzanita stand out among the scant new growth with a significance truly pathetic. Here, singing the song of the Pine serenely amid the silence of desperate struggle all about it, was found a single specimen of *Pinus monophylla*, a fine healthy young tree some twenty feet in height with a girth of eighteen or twenty inches near the base.

Further on, several small trees were met with, but with the exception of this small scattered group the species was not encountered in the locality. All these trees had borne seed for some years, but no seedlings were to be seen, nor did there appear much likelihood of any obtaining a foothold for some time to come.

Still higher, where the cañons break

steeply out of the mountain's flanks, marshaled in battle array, usually on precipitous inclines, stand the serried columns of the Southern Douglas Spruce (*Pseudotsuga macrocarpa*), weather-beaten, and often blackened and charred by fire, but holding the breaches valiantly, though in places reduced almost to a corporal's guard. Here and there, among the rank and file, towers commandingly a stately Cedar (*Libocedrus decurrens*), while on some slopes *Pinus coulteri*, a heavy artilleryman, brings reinforcements down to stem the tide of battle. At the same elevation, three to five thousand feet, are Oaks of considerable size (*Quercus chrysolepis* and *Q. wislizeni*).

The summit itself is a practically unbroken small coniferous forest, generally more open than the great forest of the Sierra Nevada or the dense growth of the Redwoods in the coast ranges. There is little or no underbrush, so that the tall Pines and Cedars standing somewhat aloof from each other and affording long vistas suggest rather the park than the forest. Under foot is a thick carpet of grasses and other low *herbaceous* growths, springy as turf, and spangled with flowers even in July. Conspicuous among the herbage appeared several Gilias, low-growing Lupines, gay scarlet Pentstemons and the usual host of Yellow Composites. Exquisite Mariposa lilies were found beneath the Pines. They had pushed their slender stems up through the thick mat of Pine needles, and their dainty flowers poised just above the brown surface seemed veritable butterflies hovering in the sunshine.

The conifers represented on this little plateau are, in order of numerical importance, *Pinus ponderosa*, *P. lambertiana*, *P. coulteri*, *Libocedrus decurrens* and *Pseudotsuga macrocarpa*. Each of the two first named occurs occasionally in almost exclusive groups, while on the other hand the *Libocedrus* is never found alone, but always mingled indiscriminately with the other species. *Pinus ponderosa* predominates on the south and west, *P. lambertiana* to the north and east. Both, as is well known, are lumber Pines of the first rank. The Douglas Spruce is rare on the summit, finding a more congenial habitat in the moister cañon-heads lower down. Young trees of all the species were found in all stages of growth. The few fallen and decayed trees, evidently dead from natural causes, were immeasurably outnumbered by the vigorous young ones.

The height of the mature Pines ranged from about seventy-five to one hundred feet, a few Sugar Pines perhaps exceeding this. The Cedars measured fifty to seventy feet. All are well-proportioned trees, the lumber value per acre being not inconsiderable. The mature trees were laden with cones, and the samples examined proved to contain fertile seeds.

No recent traces of fire were observed on the summit, though such evidences were but too frequent on the adjacent slopes. A few trees have been cut for a miner's cabin and the timbering of a shaft or two, but otherwise this forest-park is virgin. May an enlightened policy keep it so until, in common with the timber lands throughout this and other reservations, its management may be scientifically undertaken by the Nation's foresters.

SANTA MONICA FORESTRY STATION, CAL.

Last summer I climbed Green Mountain, near Boulder, Colorado, and found growing from a crevice in one of the rocks at the summit a small tree of *Pinus albicaulis* Englm., about thirteen centimeters (five inches) high and five millimeters (one-fourth of an inch) in diameter. It was unbranched, and bore a single terminal tuft of leaves. And yet this tiny tree, when carefully examined, was found to have twenty-five distinct annual rings. I know of no other case of natural dwarfing carried to such an extreme, and, therefore, place this one on record.—Charles E. Bessey in *Science*, October 28, 1898.

Progress and Effects of Forest-Growing.

By Hon. R. W. Furnas.

With every successive year the depletion of the lumber forests is deplored, and the cry raised that only a short time will intervene before the vast timbered districts will be barren areas. Owners of Pine lands materially differ as to when this famine will occur, some placing the limit at seven years, and others as far off as twenty-five years. It is a subject, although closely studied, still not demonstrable as an absolute certainty. No one knows just how much timber there is in the Northwest, though perhaps a pretty fair approximate can be arrived at, and from such an estimate is based the reasonable deduction that in a few years, at the rate timber is now being cut, the market will have to seek new fields of supply; in fact is doing so now.

Michigan forests are being thinned out more rapidly than those of Wisconsin and Minnesota, chiefly because the timber is more plentiful and attracts more dealers. It was estimated by lumber dealers and owners of Pine lands, that the main lumber region of Michigan, that is, the main peninsula, contained in 1894 about 29,000,000,000 feet. Since then 12,000,000,000 feet has been cut; subtracted from the 29,000,000,000, leaves 17,000,000,000 standing. The upper peninsula was estimated at the same time to contain about 6,000,000,000 feet, of which something like 1,500,000,000 have been cut. Thus, in the two districts, or peninsulas, of Michigan, the standing timber at present is estimated at 21,500,000,000 feet of lumber.

In two years Michigan contributed 10,500,000,000 feet. The total amount of feet of lumber cut in Michigan, Wisconsin and Minnesota in one year was 8,768,886,749 feet.

It is readily perceived, therefore, that the day is not far off, if the cutting continues at this rate, when the lumber fields of the Northwest will be things of the past. Fully alive to the inevitable result, capital is being invested in the South, particularly in Mississippi and Alabama, where the Pine belts are enormous in extent, and apparently inexhaustible. Unlike the White Pine of the Northwest, the Yellow Pine of the South grows rapidly and is not killed by civilization. The young Pines of the Northwest are not reckoned in the calculation, as maturity is too indefinite, and growth is stunted by the smoke and camp fires of the lumbermen. The hardy Yellow Pine of southern Mississippi, Arkansas, portions of Tennessee and Alabama, grow, the smoke of settlers to the contrary notwithstanding. The Mississippi Pine lands, which have attracted the attention of a wealthy syndicate of Western men, are seemingly inexhaustible. Their richness is no new discovery, and billions of feet have been cut from them and transported to every port in the civilized world.

With these figures before us, together with the well-known constantly increasing consumption of timber, and consequent growing demand, there is well founded solicitude, not only on the part of the United States, but of the whole civilized world, as to future timber supply.

The object of this paper and this brief effort will be, not so much a treatise, as to present as briefly as may be practically what has been done, what is being done, and what may be done, converting naturally timberless portions of the country into tree-growing regions. The presentation is substantially my personal experience and observation during a residence of forty-three years west of the Missouri River, in what is now the State of Nebraska.

Taking the geography of boyhood days, together with official reports of Captain Miles, U.S. Army, and the Western explorer, Colonel Fremont, relating to that portion of the National domain situated between the Missouri River and Rocky Mountains, as a basis for conclusions, there was at date of extinguishment of Indian title [illegible]

1854, nothing enticing to enterprising adventurers seeking new homes in the far West, especially in matters of tree-growing. The thought that the then naked plains would ever be transformed into groves of valuable timber was not entertained. The urgent demand for timber, however, existed, and called into requisition thought, observation and experiment.

Those of us who came first, during the years 1854–'55–'56, soon discovered, however, that particularly along the borders of streams where prairie fires were kept out, there was promising spontaneous indigenous growth of valuable varieties of timber: Oaks, Black Walnut, Hickories, Elms, Ash, Red Mulberry, Honey Locust, Hackberry, Linden, Soft Maple, Sycamore, Kentucky Coffee Tree, Red Cedar, Cottonwoods, Willows and others. Still later it was found by experiment that native seedlings transplanted into carefully prepared soil, did well, on high uplands—out on the open prairie; not only did well, but grew with remarkable vigor and rapidity, showing characteristics of excellence in quality. To those of indigenous growth, were added in time, varieties of foreign origin: Hard, or Sugar Maple, American Chestnut, White Walnut, Poplar, Beech, Birch, Black Locust, Larch, Pines, Catalpa, Black Cherry and others. While success followed efforts in this direction, only the most sanguine adventurous experimenters had faith in ultimate practical results. In further time, through an act of the Territorial Legislature, creating a board of agriculture, the labors of the board organized under its provisions, and afterwards liberal legislative appropriations, keeping out annual fires, and other aids and precautions, tree-growing in Nebraska is universally conceded a success. There is now no hesitancy or risk in predicting that in the near future this region will be known and characterized as a timber-producing division of country.

It may be safely stated that but little tree-planting was done in Nebraska, and by reason of annual fires sweeping very generally over the country, spontaneous growth was exceedingly meagre for at least ten years after organization of the Territory, and first efforts by settlers to improve and dêvelop. Statistics here presented commence with date of passage of Kansas-Nebraska Act, 1854. From that time, up to and including the year 1896, covering a period of forty-three years, official statistics, with some reliable estimate to cover dates not thus provided, it is found there has been planted within the borders of what is now the State of Nebraska, 298,479 acres of forest trees. This includes seedlings, seeds and cuttings, planted in permanent forests, groves and along highways and streets in cities and villages. Spontaneous indigenous growth, since fires have been kept from borders of streams dan ravines, is estimated to equal half the area planted. Personal observation would warrant a larger proportion. Not a few informants contend for an equal extent; some higher—even to double.

A majority, however, in various parts of the State, place the estimate as stated—at one-half.

It is safe to say a majority of the planting is made, originally, four feet by four, with a view to cutting out, first, one-half, as growth demands space, and eventually another half of that remaining—three-fourths in all. Some plant six by six; others eight by eight. Planting four by four, we have 2,722 trees to the acre; a total of 710,459,838. Add the spontaneous estimate, one-half, and the grand total is, planted and grown in forty-three years, 1,065,689,757 trees. The number of trees per acre, spontaneous growth, will more than equal one-half the acreage planted. It is estimated one-fourth of the trees, seeds and cuttings planted did not grow, and therefore do not now occupy the ground. Spontaneous growth, except where the weak have been crowded out by the strong, and such as may have been destroyed by occasional fires, it may be said all are growing. As near as I am able to learn from available statistics, there have been planted in Nebraska,

since the territorial organization, 15,838,250 fruit trees of all kinds.

Tree-planting of all kinds, I am pleased to say, is on the increase each year—each year exceeding the previous. To show something of what is just now being done, I refer to a statement made at a late meeting of the State Horticultural Society, held at Lincoln, by Mr. Stephen, of Crete. He is largely engaged in planting tree claims, and for this purpose had posted himself in the matter of statistics in that direction. There are nine land districts in Nebraska. In a single one there are 11,000 tree claims. I have stated it requires ten acres to plant each tree plain, and call it round 2,700 trees to the acre, we have 27,000 trees to the claim; 11,000 claims, and we have 297,000,000 trees for one land district, or for the nine districts, 2,473,000,000.

It has been practically demonstrated, the following valuable varieties of forest timber can be successfully and satisfactorily grown; both planted, and of spontaneous growth. Only the most valuable are named in this list:

Ash—*Fraxinus americana, F. lanceolata, F. quadrangulata, F. pennsylvanica, F. nigra*

Oak—*Quercus alba, Q. minor, Q. macrocarpa, Q. prinus, Q. velutina, Q. rubra, Q. marilandica.*

A dwarf Chinquapin Oak—*prinoides*—of shrub character grows in abundance, particularly on the bluff lands adjacent to the Missouri River, and in places in profusion on prairie lands, many acres in a body. It is a profuse bearer; nuts equal almost to chestnuts. In early days it was considered a "Munchausen story" when old settlers talked of hogs eating acorns from trees. The small growth, often not over a foot high, was loaded with nuts, and therefore easily eaten from by swine. Deer and antelope fattened on them.

Black Walnut—*Juglans nigra.*

White Walnut—*Juglans cinerea.*

Hickory—*Hicoria ovata, H. laciniosa, H. alba, H. glabra, H. minima.*

Pecan Nut—*Hicoria pecan.*

Elm—*Ulmus americana, U. pubescens, U. racemosa, U. alata.*

Hackberry—*Celtis occidentalis.*

Honey Locust—*Gleditsia triacanthos, G. aquatica.*

Kentucky Coffee Tree—*Gymnocladus dioicus.*

Linden—*Tilia americana.*

Sycamore—*Platanus occidentalis.*

Black Locust—*Robinia pseudacacia.*

Soft Maple—*Acer saccharinum.*

Sugar Maple—*Acer saccharum.*

Sugar Maple grown, thus far, little else than for ornamental purposes, lawns and street trees. There is no reason why it may not be grown successfully for forest purposes, as it thrives well where introduced and planted.

Poplar—*Liriodendron tulipifera.*

Wild Black Cherry—*Prunus serotina.*

Wild Red Cherry—*Prunus pennsylvanica.*

Catalpa, Hardy—*Catalpa speciosa.*

Cottonwood—*Populus deltoides, P. heterophylla.*

Willow—*Salix pupurea, S. cordata, S. fluviatilis, S. nigra.*

Valuable characteristics are noted of a Willow, growing spontaneous along the Missouri River, from the mouth of the Great Namaha south, to the Yellowstone north, familiarly known as "Diamond Willow." Professor Sargent names it *Salix cordata vestita.* Experience demonstrates it as durable almost for underground uses, posts, etc., as Red Cedar. Northern Indians seem to have known of its valuable characteristics. They call it "Twat," which, interpreted, signifies durable. It grows readily from cuttings, either in its natural home—the bottom lands—or out on the high upland prairies.

Box Elder—*Acer negundo.*

Chestnut—*Castanea dentata.*

Pine—*Pinus sylvestris, P. austriaca, P. strobus.*

Red Cedar—*Juniperus virginiana.*

Larch—*Larix europæa, L. americana.*

Mulberry—*Morus rubra, M. alba, M. monetti.*

Many varieties of less value than the foregoing, embraced in a complete sylva

of the States, are here omitted, as not of practical value for forest purposes.

The following actual measurements of tree growths, of known ages, were made by Hon. J. Sterling Morton and myself, a few years since, showing circumference in inches, two feet above ground:

	Years Old.	Inches.		Years Old.	Inches.
White Elm.	15	24½	Black Walnut	22	48
White Elm	24	63	Black Walnut	16	18
Red Elm	24	36	Black Walnut	16	15½
Catalpa	20	48½	White Walnut	16	49½
Soft Maple	18	54½	Osage Orange	25	26½
Soft Maple	18	69½	Larch	10	24
Sycamore	16	43¾	White Pine	20	36½
Pig Hickory	24	27½	White Pine	12	29
Shag-bark Hickory	24	30	Scotch Pine	15	23
Cottonwood	23	78½	Scotch Pine	10	36
Cottonwood	11	93	Austrian Pine	11	22½
Cottonwood	25	98	Balsam Fir	12	26
Chestnut	14	24½	Red Cedar	12	26½
Box Elder	14	25½	White Cedar	12	22
Box Elder	14	31½	Mulberry	18	43
Honey Locust	22	40½	Mulberry	18	39½
Honey Locust	22	41½	Russian Mulberry	6	24
Ky. Coffee Tree	14	25½	Linden	14	35
Bur Oak	22	86½	Poplar	4	12
Bur Oak	26	43¾	Silver Leaf Poplar	12	67
White Oak	22	29	Black Locust	24	60½
Red Oak	22	37½	Red Willow	20	58
Black Oak	22	38½	Gray Willow	15	26½
White Ash	22	32½	Yellow Willow	21	132
Green Ash	22	30			

I give no measurements as to height of trees, as all this depends on the distance apart they are planted. Isolated they are low headed, close together they run upward, as all well know.

The order of ultimate value, deciduous varieties, while there may be difference of individual opinions, it is safe to arrange: White, Bur and Chestnut Oaks, Black and White Walnut, White, Green and Blue Ash, Black Cherry, Catalpa, Black Locust, Honey Locust, Kentucky Coffee Tree, Elms, Hickories, Larch, Soft Maple, Hackberry, Mulberry, Cottonwoods, Willows, Box Elders. For present or near value, Cottonwoods—especially the Yellow—were at first almost universally conceded preferable. There are, as shown, two varieties, Yellow and White—*deltoides* and *heterophylla*. The Yellow makes excellent lumber, particularly for inside uses, not exposed to weather. For shingles only Pine, Cedar or Walnut are superior. Both make good fuel, after reasonable drying or seasoning. Old steamboat and mill men prefer half-seasoned Cottonwood to any other obtainable in this region, claiming they get more steam from it. Also much used in burning brick. No other wood holds nails so well. Recently the White Cottonwood is attracting attention for use in manufacturing paper, the pulp from which is pronounced superior. This may, some day, become a feature in Cottonwood culture.

Evergreens stand in order of value: Red Cedar, White, Scotch and Austrian Pines, Norway Spruce and Arbor Vitæ Of late many of our native varieties of evergreens from the mountains have been introduced and grown with success. The Silver Fir is, in my opinion, the most desirable evergreen grown for ornamental purposes. Several varieties of Pines are valuable for forest purposes.

The order of tree-planting, numerically speaking, of deciduous varieties, was as said, until more latterly, as near as may be: Cottonwoods, Box Elder, Soft Maple, Elms, Ashes, Black Walnut, Honey Locust, Catalpa, Oaks, Hickories, Kentucky Coffee Tree, Black Locust, Larch, Sycamore, Hackberry, Mulberry, Black Cherry and Willows. Two-thirds of the whole were cottonwoods, from the fact that they are most easily obtained; cost less; are of more rapid and certain growth, and from which realizations are more speedily and certainly secured; and in addition, succeed almost anywhere. But of late, the hardwood varieties predominate largely Ash more particularly; Walnut next, then of the Black or Wild Cherry.

Evergreens are planted in order: Scotch Pine, Red Cedar, White and Austrian Pine.

Spontaneous growths range in order of value: Oaks—Red and Black perhaps predominating; Hickories—more Shagbark than others; Black Walnut, Elms, Linden, White Ash, Mulberry and Hackberry on higher lands. On bottoms, Cottonwoods, Box Elder, Willows, Sycamore, Soft Maples, Green and Water Ash.

Prices of forest tree seedlings are such

as to place them within reach of the very poorest. In fact, as the great bulk planted are of spontaneous origin, they are to be had for mere gathering, in regions where found. When trafficked in, prices range, owing to variety and size, from six inches to four feet, all along from one to three dollars per thousand. Nursery grown, range grades higher.

Cost of planting depends much on circumstances, price of land, labor, varieties planted, skill in planting, and many other minor details. Cottonwood seedlings can be furnished in quantity from one to two dollars per thousand; Box Elder and Soft Maple, from two to three dollars; Oaks, Ash, Walnut, Hickory, Catalpa and Chestnut, from three to five dollars.

The usual distances apart are by multiples, 4–8–12–16, etc., that intermediate ground may be utilized by being cultivated in other crops until trees are sufficient size to protect themselves, when, in farm parlance, they are permitted to "take the ground."

Many experimenters plant tree seeds where they are to remain permanently. Experience has shown this a mistake, for numerous reasons. Principally, by this mode, uneven stand, growth, grade, size and vigor are to contend with. By planting seeds, first in beds, and say, at one year's growth, assorting, grading and transplanting permanently, each grade to itself, better results are secured. Same grades as to size and vigor do better together; grow more evenly; the weak are not crowded out or overshadowed by the stronger—a practical illustration of "survival of the fittest."

By this plan small plants, if healthy, do about as well in the end as the large. No variety is known not readily transplanted at one year old. Even varieties of tap-root characteristics, Oaks, Walnuts, Hickories and Chestnuts, are really better, I am convinced, for tap-root pruning. By it, laterals or fibrous roots are induced; or if larger sizes are desired before transplanting, root pruning, by running a tree digger under the rows, and allowing them to remain a year or two longer, good results are obtained. As a rule, however, better success is had by transplanting young trees, when, as near as possible, all roots are preserved. Small trees cost less to purchase, transport, handle and transplant.

Alternating—especially certain varieties—has not given satisfaction. Trees in some respects are not unlike mankind—will not fraternize. For instance, Oaks, Walnuts and Hickories will not fraternize with Maples, Cottonwoods and Elms. When planted near each other, the latter will invariably lean away from the former, assuming a crooked, gnarly appearance, and in the end virtually die out.

Thus far few ills have attended timber culture on the plains. The great losses or failures have been from careless handling, planting and after-neglect. Black Locust was planted extensively in earlier days, but being so badly affected by borers, its cultivation, until of late, was almost entirely abandoned. The pest, which almost universally destroyed in the beginning, suddenly and without cause disappeared, and that valuable variety of timber is again receiving merited attention. I regard the Black Locust as one of our most valuable varieties, and worthy of more extended cultivation.

In certain portions of Nebraska, during one or two years, a large green worm—name not known—defoliated most Soft Maples, for a time checking their growth; in a few instances the same borer attacking Black Locust, to a limited extent injured Soft Maples and Cottonwoods. They being of such rampant growth, injury was not material. Trees attacked were principally those used for ornamental purposes—those on streets in cities and villages. Where ground has been well and deeply prepared, good healthy plants used, care exercised in handling and planting, followed by attention and proper cultivation, until able to care for itself, there has been no good cause for complaint.

Too much importance cannot attach to spontaneous timber-growing. Nature,

in this respect, is both accommodating and bounteous in her provisions. Waste places, as a rule, are utilized. Lands, if at all adapted to other uses, could only be prepared at extra expense, are those nature occupies and renders of value. This growth comes of its own accord, so to speak, without preparation or labor by man, other than to guard against fires along broken and often precipitous bluffs and ravines, in nooks and corners of tortuous and meandering streams, incident to prairie regions.

A belief is freely expressed that greater proportionate successful tree-growing, and at comparatively no expense, has been done by nature, than by man planting. As stated before, by far greater proportions such planting and growing stands and succeeds than that of artificial processes. Losses are rare, and only from occasional invading fires, and where too thick on ground the stronger kill out the weaker—no loss in fact, simply adjusting or equalizing.

Personal knowledge is had in many instances, where lands twenty and twenty-five years ago were considered worthless, have grown to be valued at from twenty to one hundred dollars per acre, solely for the timber value nature planted and grew.

In conclusion let it be remembered, "Man's conquest over nature is not for a generation, but for all generations. One bequeaths its work to the next. The old builders knew, or rather limitations on them, compelled observance of this law. They attempted not to complete a great work in a single lifetime. They laid foundations broad and strong. They built as though they meant endurance. They did what they could, and left that unfinished to their successors. So the great walls of the masters remain to-day a wonder to the world—solid in fabric and rich in ornamentation." Let these truisms point the way to those who aim to rehabilitate the denuded, or invest naturally treeless domain.

The Forest Fires.

By Abbot Kinney.

The Sierra Madre range constitutes the main watershed of the springs and streams of Los Angeles and San Bernardino Counties. The conditions of this mountain watershed determine the delivery of the rainfall upon it to the valleys below. The fact is fully established that a forest covering, whether of trees or brush, delays the delivery of a given rainfall. The more forested a watershed is the slower is the delivery of the rainfall, consequently the springs and streams are more perennial in their character under such conditions, and the danger from flood is diminished. On the other hand, a bare mountain watershed offers no delay to the escape of the rainfall. There is no opportunity for the rain to percolate through the soil or to enter water veins through which it is delivered months or years after it has fallen. The delivery of the rain from a bare mountain watershed is necessarily sudden and diluvial in character. Such a watershed produces torrents, now raging and destructive and again arid wastes of sand and boulders. Floods replace the regular flow of springs and streams.

Those acquainted with human experience and disaster from undue deforestation of mountain watersheds have long urged these matters on the people of California. Action to protect our mountain watersheds has been commenced. First, the most important forest areas were held out from sale and constituted into permanent reserves. For a long time nothing more of a practical kind was done.

No system for the management or protection of the forest reserves was inaugurated. This year the Secretary of the Interior has authorized the employment of forest rangers. A considerable number of these have been employed both in the Sierra Nevada and in the Sierra Madre, but still without any general and adequate plan of action.

While these two things, the establishment of forest reserves and the appointment of men to protect and govern them, are most important and promising, it is clear that we have now come to the point where an adequate plan of action should be formulated. Such plans have been made and submitted. The plan for the Sierra Madre range, submitted long since to the Government officers, is as follows:

Establishment of a patrol at the commencement of the dry season. Such patrol could either be of specially appointed officers or details from the army. In either case the patrol should be under permanent civil forest officers. Establishment of such patrol in central distributing stations located so as to be accessible to the largest possible forest area in each case. Establishment of various signal stations so as to cover entire forest area. Mapping in duplicate the area under each signal station and the division of such area into numbered districts. One map to be at the signal station and one at the patrol headquarters. Connection of signal station by telephone lines with patrol stations. Such telephone connection was found to require but little new work, as existing lines could by short extensions cover most of the area involved. Construction of trails, where none exist, from patrol stations so that access would be easy to all parts of the reserve.

This is the first outline for fire protection. With this system the first sign of a forest fire would be immediately reported and the trained and prepared patrol be on its way to control it. The general estimate is that a forest fire requires from eight to twelve hours to gain a dangerous headway. The outline map with signal and patrol stations presented with this plan demonstrated that a battalion of cavalry could be located so as to have adequate patrols, within six hours at most, of any section of the Sierra Madres.

Such a system would give us perfect insurance against any very destructive forest fires. Besides this, it was proposed that there should be a station on each of the trails or roads entering the forest reserves. At these stations visitors for any purpose to the forests would be furnished free of charge a permit to travel therein. The permit would state the route to be followed and the time to be occupied. This would be entered in the station book. Each traveler would receive his permit, a copy of the forest rules as to fire, etc., and a statement that he would be held responsible for any violation of the same. In this way every visitor would be advised of the rules and precautions necessary for the common good in the forests. He would also know that his location in the reserve was known to the forest officers and that violations of the rules could be traced to him. Every visitor to the forest would in this way be made to feel his personal responsibility for fire-setting, etc., and would know, further, that there was an efficient patrol within striking distance.

I believe that every forest lover hates to see the forest destroyed by fire. Every irrigator, and in fact, every one on any watercourse, is personally interested in the preservation of our watersheds. It must, then, be an occasional and irresponsible fool that starts the wasteful and deadly forest fires, or, as is more often the case, the man ignorant of our conditions and careless in his camp or other use of fire. A complete system on these lines will, in my judgment, end the forest fires in Southern California.

The areas already fire denuded might well be planted with the local Spruce and the more hardy drouth pines such as *P. sabiniana*, *P. attenuata*, *P. coulterii*, etc. There is no time to lose in this business of watershed protection.

The Hon. Binger Herrmann, Commissioner of the General Land Office, has expressed himself as favoring the extension of the Yellowstone Forest Reserve with a view to the ultimate inclusion of the entire area as a part of the National Park.

Tree Planting in Nebraska.

By E. F. Stephens.

The people of Nebraska have from the first settlement taken a marked interest in the planting of trees, groves, windbreaks and shelter belts. Most of our people came from States which had more timber than we, and as they settled on these wide, rolling prairies and broad tables, their first resolution was to surround themselves with orchards, trees and groves, that they might have the fruit of the one and the shade of the others.

A very great impetus was given to this feeling by the passage of the Timber Culture Act. The attractive conditions of non-residence, freedom from taxation for a period of 8 to 13 years, coupled with the requirements of only ten acres of trees to be planted and cultivated to acquire 160 acres, made this method a favorite with those who desired land of their own. Perhaps it would be of interest to mention that in the North Platte land district alone more than 11,000 tree claims were filed, and that reports from nine of the eleven land offices in the State show that 28,474 timber claims were filed on. Figuring that all of the timber claims have been planted once in the effort to secure trees—and some of them have been replanted—on the legal basis of 27,000 trees per claim we have the number of 568,898,000 trees planted. Doubtless during the years 1885–90, years in which the largest number of trees was planted, there were single seasons when as many as 100,000,000 trees were planted. One nursery firm sold upwards of 30,000,000 trees in one season, and all nurseries had a large trade.

One of the weak points of the Timber Culture law was in granting 160 acres of land simply for planting and cultivating the trees for a brief period of time. As four years' time was allowed for the preparation and planting of the ten acres, only four years more of cultivation was required to secure title to the land. In the majority of cases the primary object in planting was not to secure a grove for its economic uses and shelter, but rather to acquire land on very easy terms. Having made proof and secured patent, the greater portion of the planters ceased to cultivate and in very many cases neglected to maintain fire guards. It is fair to state that whenever healthy, suitable trees were planted on land well prepared, and the trees carefully cultivated and kept free from weeds, excellent success was attained. The better handled class of claims made proof with an average of 20,000 or more living trees on each 10 acres, or three times the legal requirements.

Unfortunately the necessity for further cultivation and protection being removed, groves were allowed to fill up with weeds. While proper cultivation and the entire absence of weeds will retain moisture enough for the growth of timber on any of our Western tables, it does not seem possible to maintain thrifty groves and a full stand of weeds on the same plat without serious loss of moisture. Then when a season of unusual aridity comes, stored-up moisture having been depleted by a heavy growth of weeds added to that required for the trees, there has oftentimes been a serious loss of groves.

Doubtless our people with larger resources will again make proper effort to plant needed windbreaks and shelter belts, and in the prosecution of this work perhaps our experience in planting 2,700 acres of forest trees may be useful to future planters.

While it has been found entirely practicable to break raw prairie, disc-plow double depth, thoroughly prepare it, and plant trees with success all in the space of one week, yet where time can be allowed the easier and cheaper method has been found to be to break the prairie to the depth of 2½ to 3 inches during the time when the grass is growing, with the certainty that the sod rots better when broken at that time. Roll flat each day's breaking that the sod may act as a mulch retaining the major portion of the moisture, causing the grass roots in the sod and a few inches below to decay more rapidly. Then backset from September

to October of the same season, leave rough to catch the drifting flurries of snow in winter, which melts and adds to the moisture available for the second season's work. There seems to be no advantage in raising a crop on the ground for a season before planting trees. Fresh, clean land is so much freer from weed seed that it is better to use additional horse-power needed to suitably prepare the land in one season, rather than to use two years in the work. Before planting the soil should be plowed to the depth of 8 to 10 inches and thoroughly pulverized.

Plant strong yearling trees of suitable varieties the first spring after breaking. The land having been thoroughly pulverized by the use of discs, pulverizers, harrows or all together, mark each way 4 by 4 as in ordinary marking for corn. With a little practice an expert workman attains dexterity and skill enough to plant 2,700 trees or one acre in a day of 10 hours. This was regular work for the force. To a force of 10 men there should be a boy to keep the plants wet and distribute to each planter.

The essentials of success are that the ground should be thoroughly plowed, pulverized and put in fine condition. In planting, the planter thrusts his spade to the full depth of the blade at the intersection of the marks, throws the handle forward, thrusts down a plant two or more inches deeper than it grew, withdraws his spade, tramps soil to the plant as he passes to the next. To maintain a loose surface and keep the plantation free from weeds requires, according to the condition of the ground and the character of the season, from four to eight cultivations. During the month of August or early in September a fire guard four rods in width is required. This cultivation was maintained for the space of four years, by which time, where the soil was of fair quality, many of the groves were too large to cultivate.

Contrary to the usual thought, it is quite practicable to grow a plantation of trees where it is not possible, from lack of moisture, to grow a crop of corn or grain. We noted on the table lands of western Nebraska and eastern Colorado that at the time of breaking the rainfall apparently had not penetrated to a greater depth than 18 to 24 inches, and apparently those table lands had rarely, if ever, been wet down to the depth of 30 inches. In repeated instances where we dug to test, no more than 18 inches of moistened soil could be found.

The breaking of the prairie and the rolling of the sod retains a large percentage of the moisture contained. Each additional shower the season through adds somewhat to the amount of moisture available. During the first season the trees are small and require very much less moisture than a stalk of corn or a stool of grain. Suitable cultivation retains a large percentage of moisture in the soil, and of the rainfall which nature gives. These small trees planted four feet each way can absorb but a small per cent of the moisture nature has given. At the end of the second year the conditions are much the same—that is, the trees are yet unable to absorb even the greater portion of the moisture available. The succeeding winter these young trees serve to catch a little snow which melts and adds to the moisture contained in the soil.

By this time the moisture, which had penetrated no more at first, perhaps, than two feet, has soaked down three feet. The succeeding winter yet more snow is caught and an additional amount of moisture conserved, until by the time the trees are large enough to require an additional amount of moisture it is stored up in the soil and available for use. As an illustration along this line, it may be pertinent to mention that in an orchard on the St. Francis table in Cheyenne County, Kansas, after three years of careful culture without crops, it was found by boring with soil augers that moisture had penetrated into the subsoil to the depth of 16 feet.

Apparently successful groves should be cultivated until the spreading branches shut out all weed growth, and conserve all the moisture for the direct use of the

trees and groves. When the trees get too large to stand at the distance of 4 by 4, judicious thinning is necessary. It has not, however, been found wise to trim off the lower branches of the tree and allow all the trees to remain. The lower branches are especially useful in shading down weed growth, in protecting the trunks of the trees, and in guarding against the conditions which favor borers.

VARIETIES OF TIMBER.—In the central counties of Nebraska the Catalpa does well, grows rapidly, and makes valuable groves. The Russian Mulberry also does well in the same counties. The writer cut a Mulberry tree in Hamilton County that had made a diameter of 10 inches in 12 years and was of a height of 25 feet. Because of its ability to withstand drouth, large numbers of Mulberry have been planted as windbreaks and groves. I regret to state, however, that the Mulberry and Catalpa have not been as successful as we expected in the extreme western counties of the State and eastern Colorado. Perhaps the elevation may have something to do with it, but apparently each variety grows too late in the fall and is caught with unripe wood, and suffers from winter.

The Ash proved to be the tree which could withstand the greatest amount of drouth and cold, and was most uniformly successful in securing a stand. In one contract of 750,000 trees we secured a stand of 98⅝ per cent of the Ash. The growth of the Ash, however, is slow, and cultivation is required for a greater number of years than with leafy trees like Box Elder or Catalpa.

The Black Locust did fairly well as far out as Kimball County; and in counties like Lincoln, with a little greater amount of moisture and a looser soil, the Black Locust not infrequently was too large for cultivation at the end of the second season, could be with difficulty got through the third season, and it was impossible to get a horse through it the fourth season. We have in mind a very successful grove of Black Locust in Dawson County which the owner regards as very valuable from its habit of renewing itself quickly from the stump, and as valuable timber for posts.

The Box Elder succeeds fairly well over almost the entire range of western Nebraska and eastern Colorado, and yet under neglect, and when the groves are filled up with weeds this tree cannot endure the same dryness of soil and subsoil as the Ash.

In the planting of evergreens in the central counties of the State in a contract of 45,000 trees, 80 per cent were saved, all these being planted in ground the first year after breaking, using mostly root-pruned Spruce and Scotch and Austrian Pines of the height of about twelve inches.

At the present time the area of timber in the State of Nebraska is so much greater than thirty years ago, that timber lands in the greater portion of the State are regarded as less valuable than clear land suitable for tillage. When timber shall be scarce enough and of sufficient value to justify the planting of groves for the sake of fuel and timber, then the experience of the last ten or fifteen years, together with more thorough methods of culture now coming into use, will make the growth of timber over the entire State entirely practicable. We hope at that time to see on each farm a suitable acreage of timber for windbreaks and shelter, as well as for fuel and other uses.

In September of the current year the discharge of water in Boulder Creek, Colorado, reached the lowest stage ever known. On the 27th of that month at the reading station in Boulder Canon the indicated flow was but sixteen cubic feet per second. To arrange for the equitable distribution of water for domestic purposes required the utmost tact and patience on the part of the authorities, while there was absolutely no water left for irrigation.

The Wisconsin forest commissioners report says, of Wisconsin's northern half but seven per cent is cultivated. The State uses a fifth of its lumber output.

Denuded Lands of Washington.

Frank H. Lamb in *Wood and Iron*, of San Francisco, descanting on the timber of Washington, expresses views about the disposition of cut-over lands in that State that seem to be uttered from knowledge and a careful consideration of the subject. He says that in the interior of the State, lying between the Cascade mountains on the east, and the Olympic divide on the west, there is on the plains a forest of nearly pure fir, with areas of Cedar, broken by many gravel prairies of thousands of acres in extent. The soil of the central plain is gravel, varying in size and mixed with decomposed rock and sand. On the slopes of the Cascades and Olympics there is a clay soil predominating, and in consequence a mixed forest of Fir, Cedar and Hemlock. With the exception of the growth on the gravel plains, which has been somewhat retarded and stunted by frequently recurring forest fires, 90 per cent of the forests in Washinton are mature, or ripe, as lumbermen say. No careful study has yet been made of the yearly growth of the Douglas Fir at different ages. With such data as is obtainable we must conclude that it will be more profitable to convert this mature timber into merchantable material, and thus allow the land to be covered by a regrowth, than to let the timber longer stand, providing that the operation will prove profitable.

When growing in a thick forest, Fir will attain almost its maximum height before it has reached a diameter of 36 inches. This greatest height varies from 250 to 280 feet. Its age then is one hundred and fifty years, and thenceforward it mainly increases in diameter.

That portion of Washington lying west of the Cascade mountains is peculiarly adapted to the growth of timber. By nature this great region has been set aside for the growing of timber. The question is, will it pay better to raise that to which it is adapted, or devote the land, when the original timber growth shall be cut off, to agricultural purposes, provided it can be done?

The cost of clearing the lands for farms must first be considered. Contracts made for clearing roads and town sites show that the cost has been from $100 to $200 an acre. Thus the farmer making settlement must add this cost to the purchase price of his land to make up its value when the clearing shall have been completed. With such a cost attached to simply cleared land, without other improvements, the farmer could scarcely hope to compete with the farmers of the interior whose lands were originally by nature made ready for the plow. But it is claimed by our authority that excepting the first bottom, or "bench" lands along the streams, the timber covered area is unfit for agriculture. After the land has been cleared, and the accumulation of vegetable matter is burned up, there is nothing left but gravel, mixed with sand, or a hard compact clay known as "shot clay," which will support very little vegetable life except scant forage, and this is soon crowded out by a thick growth of underbrush. After the gravelly surface has been laid bare by clearing and burning there is nothing left on the ridges to hold the rain water, and a short drouth dries up and kills vegetation. On the gravel plains nothing is left after burning over, and nothing will grow except a few shrubs and the brake. These lands then become absolutely worthless. On the hillsides, too, erosions and landslides frequently occur during heavy rains. Without the forests of Washington, our authority contends, every rivulet in western Washington would, during the floods of winter, become a raging torrent and overflow its banks, doing immense damage to the lands below. Converging at the harbors, the waters would carry away wharves and other improvements and thus cause much damage to shipping interests.

Altogether, it is concluded by the writer referred to, it is best to keep western Washington in perpetual forest. It is probable that such a conclusion is a wise one, but some plan of conservation must be speedily perfected and practically put in force or the lumbermen will

have the country cut over and reduced to the condition of the denuded lands in Michigan, Wisconsin and Minnesota. Now is the time to initiate and carry out a system of judicious cutting of mature timber, and a careful conservation of the younger growth. There is a good opportunity to try the German method in the Puget Sound country, for cutting has not yet gone beyond the opportunity to make that method practicable. The Government reserves may help in the matter, but there will still be great stretches of the gravel plains mentioned to be cared for, or else become barren and unprofitable wastes.—*Northwestern Lumberman.*

What is wanted is not the German method but an American method, which can be readily adapted to local needs and conditions, such as is suggested in Circular No. 21 of the Division of Forestry.

The Board of Health of this city is preparing a remonstrance against the opening of the forest reservation to sheep. The leading point raised in the remonstrance is the danger of contaminating our water supply. The remonstrance will be signed by the board of health and to-morrow night laid before the city trustees, who will be asked to co-operate in the matter. It will be forwarded at once to Washington. The health officers are very much in earnest in the matter. There are twelve hundred acres belonging to private parties, surrounded by the reservation. It is reported that this is also to be given to sheep pasturage by lease. This can be prevented only by legal steps, and even then it may be difficult to accomplish it.—*Redlands (Cal.) Facts.*

The growing interest in forestry is indicated in the recent appointments of professors to newly created departments in half a dozen of our big colleges and universities. By the time we have pretty much devastated our forest resources the people will have learned that restoration is more profitable than ruin.—*Ex.*

The Forest Fire in the Sierra Madre Mountains.

The following extract from a private letter of a lawyer in Los Angeles gives a graphic picture of the recent fire in the forests on the slopes of the Sierra Madres in southern California:

"The mountain fire came very near on Saturday, and I stayed over Sunday night at the Park expecting to have to move the folks down, but it seemed to have burned itself out before Monday morning, and they remained. It was a most magnificent spectacle at night. From a summit we could see mile after mile of blazing forests. The big Pine trees on the sides of San Gabriel, one after another stood outlined in fire, ablaze from top to bottom and in every branch. The roar of the fire came over like the sound of a distant waterfall. Before it died away, the conflagration was almost at the foot of the canyon near the top of which is our camp. We should have had to run the moment it reached the foot, for it runs up the slopes among the thick trees with amazing rapidity. We watched it sweep up slope after slope on the opposite range. The papers say that 45 square miles were burned over, but I am satisfied that the area of forest and brush destroyed is not less than 100 square miles. The inspector, or whatever his title is, who had charge of the efforts to extinguish the fire is taking great credit to himself for what he claims to have done. In fact, I think he accomplished just nothing at all. He had *carte blanche*, but instead of putting two hundred men at work he had only twenty, and much of the time less than that on the east end of the fire.

"The only way to save the timber is by means of a strong patrol and extremely vigorous punishments. Some fires are set carelessly; some intentionally by hunters. This one is supposed to be due to carelessness. Of course it is not out yet. It will smoulder for some days or weeks, and may very likely break out in some new direction and sweep over a large area."

On the 4th of November the Government authorities made an important seizure of property at Fort Steele, Wyoming, taking possession of 47,000 railroad crossties of which 17,000 were banked ready for delivery to the Union Pacific Railroad Company and 30,000 stored in the tie booms of Platte River. The seizure was made by United States Marshal Hadsel, who at once placed the property in the possession of George B. Abbott, who is the special timber agent in Wyoming for the Interior Department. The ties were cut at the Teller tie camps along Brush and Mullen creeks in Carbon County by J. C. Teller, who has had a large force of men employed for the past year. It is alleged by the officers of the Government that Mr. Teller has been cutting the ties from Government lands without complying with the necessary forms of law. He is charged with having illegally cut over one hundred thousand ties in this manner. Several months ago an investigation was made by Agent Abbott of Mr. Teller's tie-cutting methods and the tie camps were closed and the ties taken possession of by the agent. Subsequently the ties were released and the work of floating them down the river and delivery of them to the Union Pacific Railway Company, which had contracted for the entire product, was resumed. It is claimed that Mr. Teller failed to satisfy the Government claim and suit was instituted against him under which the seizure was made. The value of the property seized is $18,000.

The value of all the gold, silver, iron, copper, coal and lead mined every year in America is exceeded by the products of the forests. Even the combined wheat and cotton crop is less in value than the forest products.

The Pennsylvania Forest Commission has purchased at tax sales for the Commonwealth during the past season 55,681 acres of land, but no purchases have been made under the reservation act.

If the farmer, with an assortment of poor, scraggly, hillside land, were to select three to five acres of it and plant nut trees thereon, seeing likewise that the young saplings were kept alive and cared for during the first period of their existence, in not many years his lean and unsightly hillside would be the most valuable portion of his ground. Nut food is becoming more and more popular every year. It has been found to take the place of both bread and meat to a considerable extent.

The Hickory tree, the Chestnut and many varieties of Walnut will grow anywhere in the United States. The best Chestnut is the Japan kind, as hardy as our own. The Pecan will also grow in nearly every part of the country, although Texas is the banner State for this nut. In the South and Southwest the Almond and Persian Walnut, miscalled the English Walnut, flourish and bear abundantly.

Most ruralists plant shade trees about their grounds. Varieties of Maple are popular for this purpose. But why do they not plant the magnificent, spreading Chestnut tree? It will grow nearly as fast as the Maple and will have a solid economic value every year, generation after generation.

The California State Board of Trade has taken up the subject of the destruction of California forests and places itself on record in the following timely resolution:

Whereas, The destruction of California forests by fire is a burning issue which commands the attention of this Board; therefore,

Resolved, That the California State Board of Trade requests of the Yosemite commission, the federal superintendents of forest reservations, the Sierra club and other organizations and public authorities concerned, co-operative action with this board to secure from the legislature of this State such action as will secure the adequate policing of our forests and the just punishment of all persons guilty of forest arson.

Cuba contains 17,000,000 acres of virgin forest, in which are to be found upward of forty species of valuable hard woods. The lumber industry, like indeed, most of the island's resources, has been neglected under Spanish rule. The wood which comes to the market in largest quantity from Cuba is Cedar, which is wonderfully abundant in Pinar del Rio and the East. Other woods from Cuba are Mahogany and lignum vitæ, both very plentiful. The common Mahogany of the island sells in this country and Europe at from $110 to $180 per 1,000 feet. Another kind called Figured or Birdseye fetches from $400 to $600 per 1,000 feet. It has been known, indeed, to sell as high as $1,250. The Cuban lignum vitæ, the finest known, is much in demand, bringing from $25 to $40 a ton, the extra quality $45. And there are many other woods which would be valuable if only brought to market.

Referring to Prof. Fernow's exposition of the peculiarities of woods, it is hardly to be expected that lumbermen will very generally become what the professor is, a master of the science of forestry, but there is no doubt but that the advantages accruing from such knowledge are worth cultivating. We do not believe that all lumbermen are vitally interested in all of the scientific quirks relating to the chemical, structural and other like technical peculiarities of the great variety of woods indigenous to the country, but we do think that lumbermen would be materially advantaged by a larger knowledge of such peculiarities than as a rule they possess to-day.—*The Timberman.*

Hon. Loyd L. Carter, United States Receiver for the Shasta Land District in California, calls attention to the fact that no forest reservations have been created north of San Francisco in that State. He deplores the destruction of timber that is taking place in the vicinity of Mount Shasta, and urges the necessity of immediate establishment of a reservation in that region.

Possibly the wholesale deforesting of the Colorado mountains by the fires that have been raging there for many days may have a useful effect in hastening the time when tree planting on a large scale will be undertaken not only there, but throughout the country. The great middle west is already very much alive to the importance of preserving its water supply and the destruction of the forests shall have its anticipated effect in diminishing the streams, it will not be long before the people of that section will throw their characteristic energy into the business of replacing the forest growth and extending it as far as may be necessary. From them, perhaps we, in the east, who have witnessed with so much indifference the destruction of our own forests, may possibly catch the enthusiasm and make some worthy effort to replace our vanished trees. If all this should follow, the burning of the Colorado timber will be a blessing in disguise. —*Philadelphia Ledger.*

The forest fires in northern Minnesota and Wisconsin have resulted in the destruction of countless numbers of birds. They have been seen in great abundance on Lake Superior, the steamer Yukon recently arriving in Duluth with six hawks perched in the rigging. The birds were too exhausted to fly further, and had apparently taken refuge on the vessel to escape drowning in the lake. In many cases helpless birds were seen floating in the water, which, on the approach of the vessel, attempted to rise and fly to it for security.

During the late summer and early autumn 219 forest rangers were employed in patroling the forest reserves. With the beginning of winter in the mountains this force has been gradually reduced less than one-half on all reservations, except those in Arizona and southern California, and there will be a proprotionate reduction there as soon as local weather conditions render such action safe and expedient.

For several centuries timber cutting has proceeded in Bohemia, Europe, and yet the primeval forests retain almost their original area. This is due to the forethought of the government, and the regulation which provides that as trees are cut down others shall be planted, or young trees preserved, so as to maintain a complete stand in the forest growth. The timber is mostly Pine. Wherever a clearing is made small trees are set so as to cover the denuded space. The trees are raised in small enclosures in the mountains, from whence they are transplanted.—*Northwestern Lumberman.*

Mr. F. Schuyler Mathews, whose books on popular nature study have become so widely and favorably known, has recently published, through the Appleton's, New York, a work entitled, "Familiar Life in Field and Forest," treating especially of the forest animals, their faults and merits and many lively anecdotes about them.

In this, as well as in his former books on our native forest tree and our birds, Mr. Mathews has endeavored, directly and indirectly, to engender a critical attitude toward the ruthless destruction of all our natural resources, and in view of the popularity of his writings his truthful lessons may be expected to bear valuable fruit.

It may be said that there are now fewer violations of the National Park and forest laws of the United States than ever. Cleveland's reservation proclamation is not working the hardship that people thought it would, and all classes are glad that the Senate amendment to the Sundry Civil Bill, abolishing the reservations, did not prevail.

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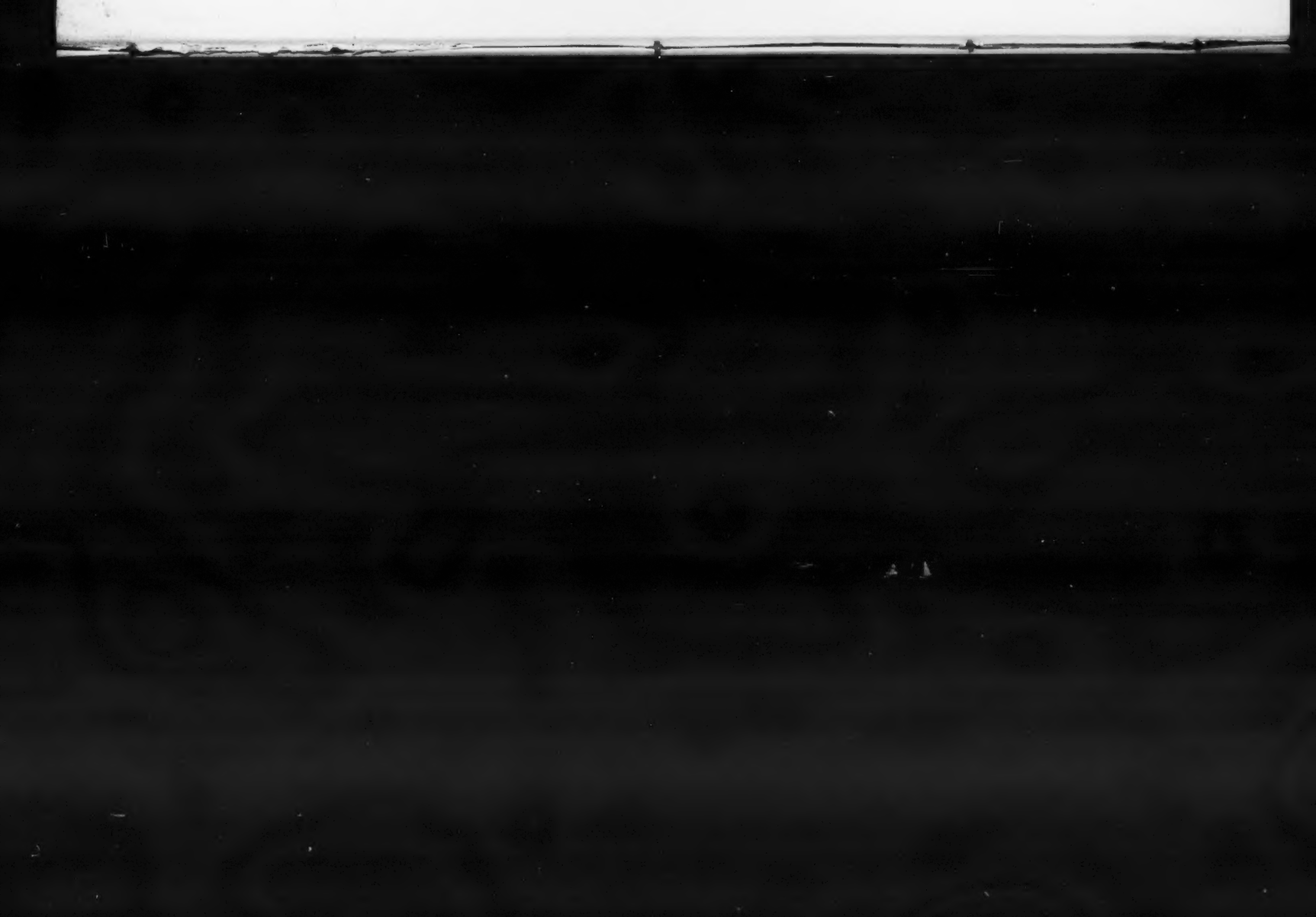

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